Project title: **Global Synthesis of POC Using Satellite Data calibrated with Transmissometer and POC Data from JGOFS/WOCE**

W.D. Gardner, MJ Richardson, A. V. Mishonov

Texas A&M University, Department of Oceanography

A. Data Reduction

Data collated during the first year of the project consist of raw data from 19 WOCE, 22 JGOFS and 9 other (S.A.V.E., WBEX, McTT, etc.) cruises. The total number of transmissometer casts: 2239 (WOCE) + 1568 (JGOFS) + 603 (others) = 4410.
For data storing and handling a large-capacity (40Gb) hard drive was bought and installed in our primary computer.
The global map with station locations is shown in Fig. A.1.

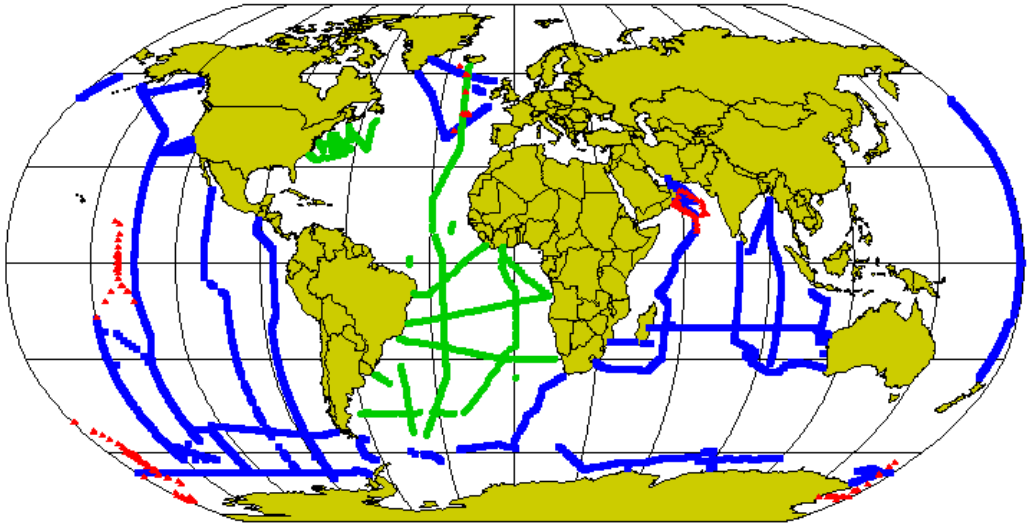

Figure A.1. Transmissometer station locations: WOCE, JGOFS, S.A.V.E, N.A.B.E, WBEX, McTT and other data have been used. Black dots – WOCE, Grey triangles – JGOFS, Grey dots – Others.

The same procedure for data reduction was applied to all raw-data available. This procedure was quite complicated and consisted of several steps briefly described below:

1. Raw-data files were processed by means of a specially designed software utility which works with down and up casts. This utility included:
    a) Spike removal (window check);
    b) Pressure checking and filtering – sometimes the CTD-probe made a brief up loop due to ship heave during the cast, so it was necessary to check the pressure values for the linearity and to filter the breaks;
    c) Additional spike checking and removal (gradient check) – the depth binning procedure of the spike checking was tuned for the upper 200-300 m layer where spikes could be quite large. At deeper depths spikes were sometimes too small to be recognised due to wide margin setting, therefore the special gradient algorithm was applied, which analysed the variations of the signals on the neighbouring depths based on their gradients;
    d) Data binning (from 0.5db to 2db bins) – since we often used raw time series data which were originally recorded at high frequency (30 Hz), data reduction was required. Data were averaged for 2 m depth intervals centred at the even numbers (i.e. 0, 2, 4, 6, ... m depth);

e) Instrument calibrations applied – data were recalculated from the volts to the physical units using the pre-cruise, in-cruise and post-cruise calibration values. When in-cruise calibrations were available, those values were applied to the associated data;
f) Smoothing by means of a running average (10 db window);
g) Profile minimum value determined.

2. After the first step all data were loaded into a preliminary data base for visual checking examination which included:
   a) Checking for remaining spikes;
   b) Checking for the "Nose"-effect, (Fig. A.2a) which occurs with some SeaTech instruments;
   c) Checking for excessive signal noise;
   d) Checking for the general "profile's good behaviour", which means that each and every profile was analysed for unusual irregularities and their possible causes; after that a decision was made about possible corrections or data elimination;
   e) Checking for the necessity of a general profile shift, which can occur due to "dirty windows" instrument's sensor trend (Fig. A.2c) or instrumental offsets;
   f) The choice between Down and Up cast (Fig. A.2a & 2b) was made for further processing;

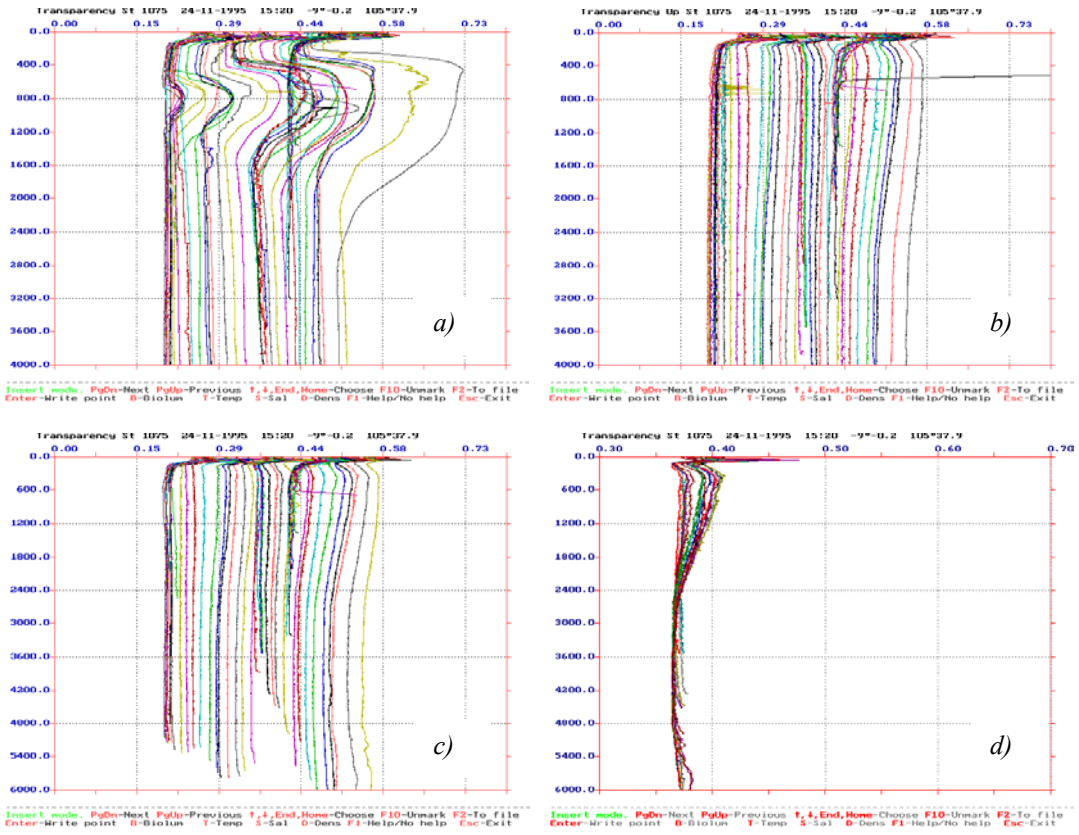

Figure A.2. The WOCE line I-10 (Indian Ocean) profiles shown here were selected as one of the cruises requiring maximum processing for illustration purposes only. *a)* – Down casts with "noses" and spikes; *b)* – Up casts with spikes; *c)* – Up & Down casts selected for the further processing; *d)* – Final set of profiles after spikes and drift elimination and smoothing.

3. After the second step data were manually edited (Fig. A.2.c):
   a) Final removal of the remained spikes – some spikes which passed through the software filtration for any reason were removed manually;
   b) Substitution of down-cast profiles – some down-cast profiles which suffer from "nose" effect or had extensive noise or any other sort of problem were replaced by the up-cast profiles when the latter were available;

c) Profile editions – some down-casts profiles, which were not backed with up-cast profiles and therefore can not be substituted, were cleaned from the “nose” or other in-regularities by eliminating some parts of the profile.

4. Assessment of general cruise trends and minimal values of profiles:
   a) The minimal value, its depth and the station bottom depth were plotted for every profile on each cruise for assessment of cruise-long decay in the instrument settings. These plots allowed us to exclude the shallow-water stations from the trend assessment if one was needed;
   b) The general cruise trend was based on the minimum signal values recorded only on deep-water stations;
   c) A trend elimination algorithm was selected (if needed) based on this assessment;
   d) "Suspicious" station determination – some stations were declared “suspicious” due to their unusual pattern or values;
   d) "Suspicious" station correction method selection – for each of these stations a decision about the usefulness of the data was made based on our extensive experience with this data;some profiles were discarded;
   e) Cruise trend correction and profile normalisation has been made shifting the whole profile so that the profile’s minimal value in deepwater (below 750m) was set equal to the cruise’s minimum. For the shallow-water stations the cruise mean minimum deep-water value was used as a profile’s minimum.
5. Final database loading: after all the above steps the data were loaded into the final database for each cruise (Fig. A.2.d), and were used for the construction of maps and sections.

An example of the section constructed for part of the I-10 WOCE line (upper 500m) shown of Fig. A.3. Similar sections were constructed for all WOCE lines as well as for the South Atlantic Ventilation Experiment, WBEX-1, McTT, Oceanus-134 and Meteor cruises. All these sections were posted on the specially developed web-site, which is described below.

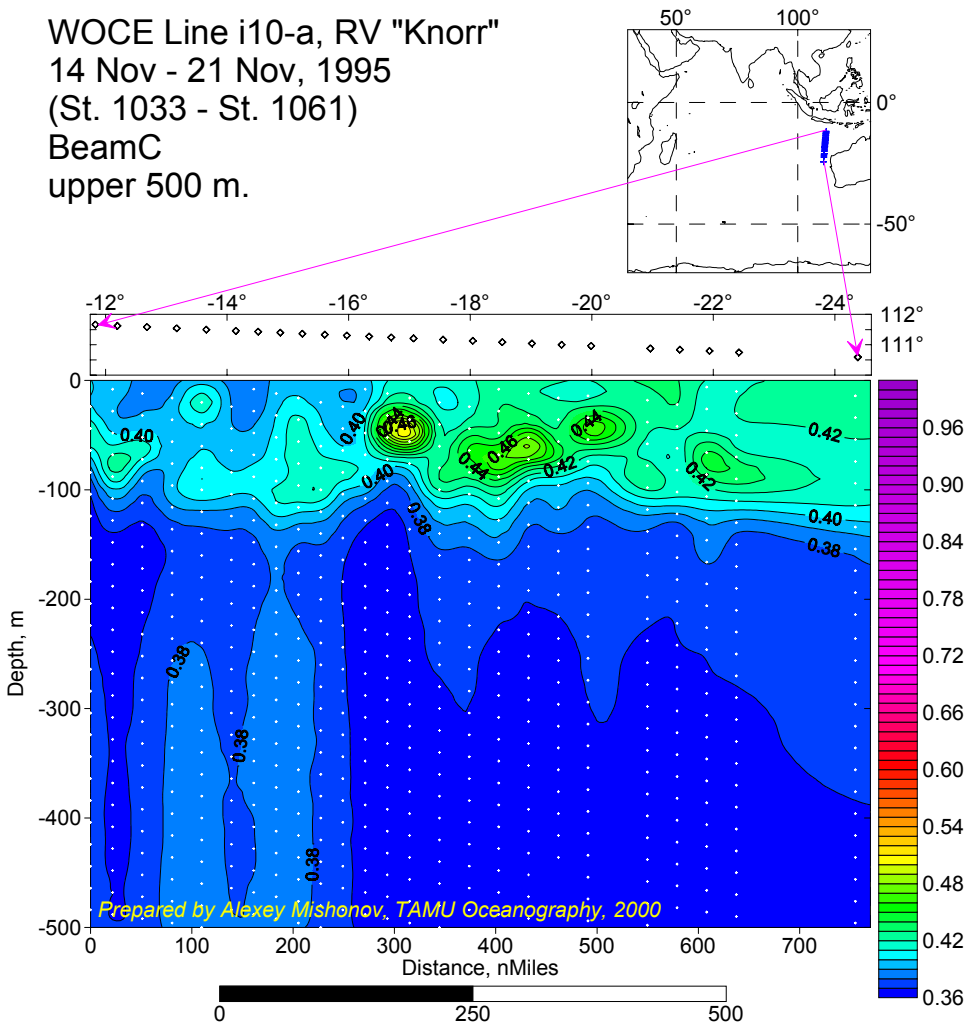

Figure A.3. Beam attenuation coefficient in the upper 500m layer. Line I-10, WOCE.

B. Web-site development

A web site was created on the TAMU Oceanography web-server for data presentation and dissemination. This web-site has been on-line since August 15th, 2000.
The web site was created using Macromedia DreamWeaver and Macromedia Fireworks v.3.0 later upgraded to the v. 4.0.
This web site can be accessed at URL: http://www-ocean.tamu.edu/~pdgroup/TAMU-SMP.html.
The web site lists the Project's milestones and provides access to the results achieved at the time of this report preparation. All steps of data processing are listed there as well as abstracts and posters presented at national conferences.
The structure of the web-site consists of the main page, publication pages, metadata inventory page, and data pages. Each cruise is presented on a separated page. Access to all cruises/lines is provided through the "Data Directory" portal (see Fig. B.1). The mapped image (global map) provides users with the ability to point and click on the desired line in order to link to separate web-pages with sections and other information (See Fig. B.2).

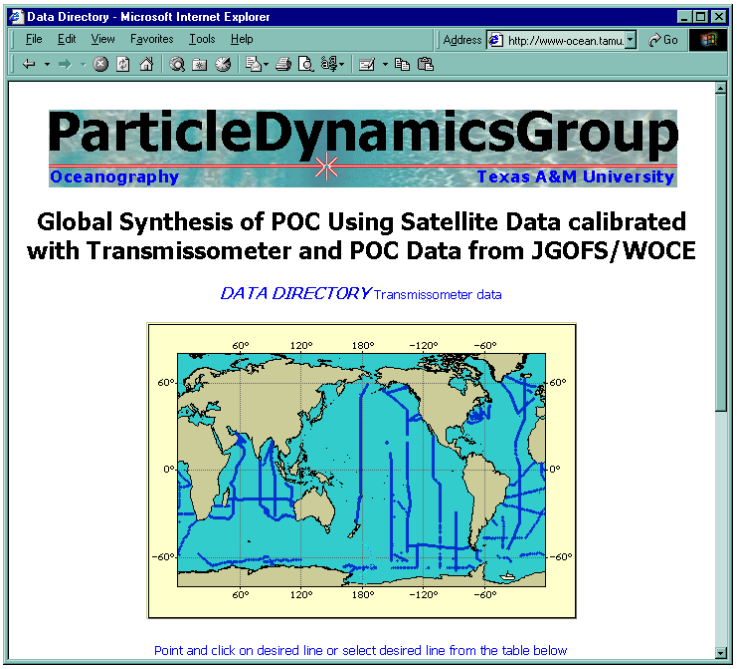

Figure B.1. Data Directory portal provides access to the all constructed Beam Attenuation and POC sections (and maps in some cases) via clickable map and/or table with links.

Currently all pages have sections of Beam Attenuation Coefficient created at 0-500 and 0-6000 m scales. Some pages, mostly in the Atlantic, also have sections of Particulate Organic Carbon for the 0-500 m layer.

The thumbnail image of the sections has a rollover feature which allows the user to see the section at a different scale (0-6000 m) while holding the mouse cursor on it. This image will be substituted by another one (section for 0-500 m layer) if the mouse cursor is moved off of the image.
The high quality camera-ready images of the sections were prepared and posted as pdf (Portable Document Format) files. These files can be accessed using the appropriate links. There are also links on all pages providing access to the corresponding cruise pages on the WOCE web site (and for to the Adobe Acrobat Reader web site) for those who want to access the hydrographic data or cruise reports.

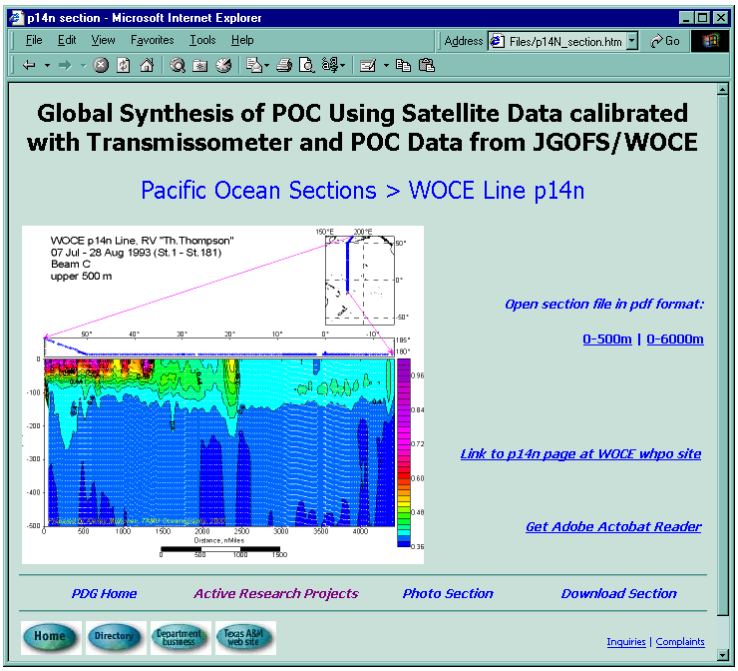

Figure B.2. Page devoted to the WOCE p14 line: Beam attenuation sections (0-500 and 0-6000m).

In the future this web-site will hold all data obtained during the Project. The POC sections will be added to all pages for the Atlantic Ocean during summer 2001. We are planning to put additional pages devoted to the Beam C_p vs POC relationships for the Pacific, Indian and Southern oceans in addition to the existing one, which has been prepared based on the Atlantic data: North Atlantic Bloom Experiment data and Bermuda Atlantic Time Series Station (see Fig. B.3).

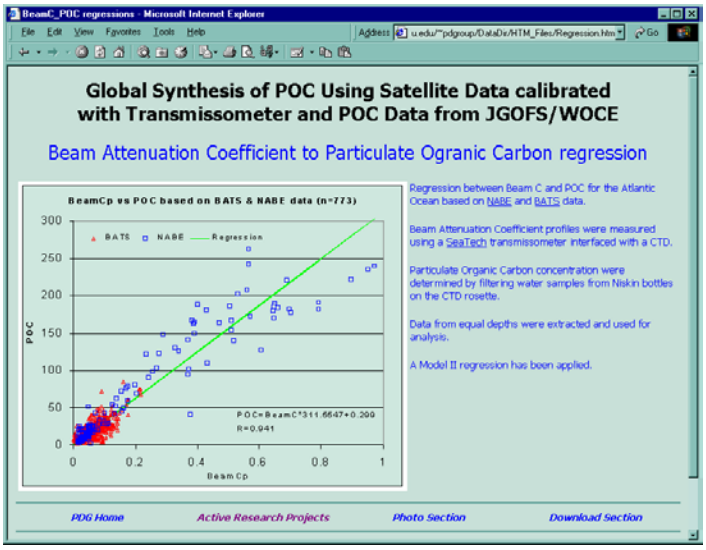

Figure B.3. Beam C_p – POC regression page for the Atlantic Ocean. Regression was constructed from NABE and BATS data.